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OCTOBER, 1961

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OCTOBER, 1961

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The Magazine Serving Engineering Drawing Management—covering drafting, reproduction and microfilming, technical illustration, drawing standards and engineering documentation.

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Measures and Measuring

by Franz Maria Feldhaus

This is Chapter IV of an authoritative and beautiful book, **THE HISTORY OF TECHNICAL DRAWING,** by Franz Maria Feldhaus published in 1959 by Franz Kuhlmann, K. G., of Wilhelmshaven, Germany, as **GESCHICHTE DES TECHNISCHEN ZEICHNENS.** We are indebted to the publisher for the translation, as well as for permission to republish this fascinating work. It will be continued in this department from month to month, until completed.—The Editors.

CONFUSION reigned for thousands of years where measurements were concerned, which shows how difficult it is to persuade man to accept a generally useful idea. The necessity of a unit of measure was realized quite early, for it was said: "With the measure you use, you will be measured also." Nevertheless, each ruler determined his own country's standard; others could come to terms with it.

How did measures originate? Here is an example from not-so-distant times: Jacob Köbel, town clerk of Oppenheim, was a man of mathematical genius who had published a book on mathematics and a geometric *Vysir Book*. He suggested the following to determine a foot. "Take 16 men, big and small, as they might leave church, let each one put one foot in front of the other; and let that distance be a fair and common gauge with which to measure the field."

The French used, until the revolution in 1789, the foot of the king as measure. From thence originates the description. Feet and lower arms of rulers were at all times the norms for foot and ell. The word "elbow" still reminds of the one-time description of the lower arm. Lengths measured in such a way used to be exhibited publicly in the old civilized countries in order that everyone might take them as their guide. During the Middle Ages churches, town halls, and city gates had metal yardsticks or gauges affixed to the outside. There are today still more than 70 towns in Germany with such yardsticks.

But mathematical and political difficulties in deciding on an international measure were very great. It was suggested for the first time in 1670 that the minute of a meridian grade should be accepted as a natural fundamental measure. The Netherland physician Christian Huygens proposed in 1672 to use a third of the second pendulum as a measuring unit for lengths. He did not know at that time that the length of the second pendulum is not the same at all degrees of latitude. The astronomer Johann Friedrich Weidler wanted to use the distance between the pupils of a grown man as a lineal measure. The mathematician Andreas Bohm, in 1771, suggested the height of the fall of a body during the first second. On May 8, 1789, a constitutional meeting of the revolutionary government decided in Paris to introduce, in conjunction with England, an international measure based upon the second pendulum. By a decree dating from July 31, 1793, France received a provisional lineal measure called "metre." By a law dating from November 29, 1800, our present meter (on the basis of the French meridian measuring of the year 1735 in Peru) was established. On June 22, 1799, a norm staff made of platinum was laid down in the state archive in Paris.

The Netherlands was the first country to accept the French meter in 1816. Prussia received, at the suggestion of Alexander von Humboldt, a copy of the Parisian staff in 1817. In 1855 delegates of the countries represented at the Paris World Fair agreed to use their influence to persuade their governments to accept the metric measure. But they were still so timid that Württemberg not France, which after all had done all the preliminary work, was put at the head of the list of signatories. The meter was accepted in England in 1864, but the English inch, established in 1101, remained in use. In other countries which had accepted the meter, the inch also remained in common use with artisans and technicians until after World War I. The German Federal State introduced the metric system in 1868; the law relating to it was proclaimed in 1873.

Because it is impractical to carry long rules around, the folding rule was invented quite early. A rule consisting of four metal rails which could be folded into VV-shape, was found in the Bieler lake; it dates from 800 B.C. In the Museo Nazionale in Naples there is a staff that had become buried in 79 A.D. It consists of two parts, one of which continues out and over the pivot and can be clamped onto a pin fitted on the staff. In this way one gets a long firm ruler. A folding ruler in the museum of Heidelberg carries the date 1629.

The transversal rules were described for the first time in 1573 by the Englishman Digges. Their inventor was the mechanic Richard Chandler of London. In 1609 Lucas Brunn of Annaberg-Transversalen invented a slide rule; it was constructed by the mechanic Christoph Treffler, Jr. Around 1627 the lawyer Edmund Mingate invented the logarithmic slide rule. These wooden slides found their way into engineering circles through James Watt in 1775.

The tape measure developed out of the measuring cord, which was mentioned as early as 750 B.C. in the survey of Jerusalem. A metal ball with measuring cord is kept in the art cabinet in the museum of Upsala; these objects were collected in 1632 in Augsburg. Measuring rolls took the place of the balls. The rolls consisted of strips of parchment about 50 feet long.

About 1825, tapes of varnished cloth made their appearance in Paris. Steel tapes date from around 1870. A tape that could also be used as a rigid measure was invented by Waldemar Petit in Berlin, and builders' rules were invented by Nicholaus Goldmann in 1662.

As early as the Sino-Japanese war it was realized that it was impractical

to carry on with this many-sidedness in technical things. It was found that a single wheel of an artillery vehicle had about 10 different types of screws, which meant that large stores of spares had to be carried along. "It is clear that all this has to be simplified," said the Russian war painter Wereschtschagin. But there it remained.

The quick development of technology in America demanded more exact measures because parts manufactured in mass production had to be interchangeable. The pioneer in this work was the engineer Carl Edvard Johansson, a Swede who had been living in the United States since 1884. After concentrated efforts during several decades, he succeeded in 1896 in putting into practice an improved measuring technique which earned him the title of "the most accurate man in the world."

The necessity of being able to interchange single parts and also the rationalization of fabrication led early to the introduction of norms. The chemist Carl Duisberg is thought to be the first person to demand standardization for a large industrial works. He said in 1895, in a memorandum about construction and organization of the large-scale planning of new buildings for the Bayer Dye Works that were being built in Leverkusen, "We must without fail as quickly as possible use standard measurements for all piping, cocks, valves, dampers, threads, screws, vats, kettles, basins, etc., that are to be used."

In 1901 the first norm committee was founded in England. Heinrich Schaechterle had achieved the establishment of a Royal Fabrication-Office in the various royal munition works in Spandau, against great resistance from military engineers and works directors. In spite of his great achievements he progressed no further than to the rank of sergeant major. Since he declared quite openly that he could not manage on his pay, he was dismissed and then received the wages of a workman. The fact that the English paid men in his field of work 30,000 marks and more, remained unheeded. At last in 1917 Schaechterle succeeded in forming the Norm Committee for General Mechanical Engineering, which was annexed to the Federation of German Engineers.

To Be Continued

Notes & Comment

Koh-I-Noor Scholarship

WILLIAM E. DANJCZEK, president of Koh-I-Noor, Inc., announced that it has again awarded a scholarship to Eugene DeFouw of Coopersville, Michigan, a technical student at Ferris Institute, Big Rapids, Michigan.

The scholarship, established last year by Koh-I-Noor, is awarded to the most deserving student in the Reproduction Technician Training and Drafting course instituted at Ferris last year.

The scholarship expresses the company's interest in the fields of drafting and engineering, and in encouraging young men to enter these fields. "We are also happy," Mr. Danjczek said, "to recognize a fine educational institution noted for its work in training engineers and draftsmen. I am delighted that Dr. Victor F. Spathelf, president of Ferris Institute, has seen fit to give our scholarship again to the same young man who won it in 1960."

Koh-I-Noor, Inc. is one of the world's oldest and largest producers of drafting equipment. The company was founded in 1790 by Joseph Hardtmuth of Vienna, the father of the modern lead pencil.

Kodak Road Show

DRAFTSMEN and reproductionists in five large cities will see two-hour educational demonstrations of some of the latest techniques in their industry this fall when three Kodak graphic reproduction specialists put on a road show based on the new Kodagraph Autopositive, contact, and projection films on Estar polyester base.

The show is put on in the form of five parodies entitled "There Must be an Easier Way." The first parody, "A Draftsman's Dream," demonstrates the advantages of drafting surfaces of new Estar base photo-reproduction films. "Restored to a New Life" shows how to update drawings, reclaim old and torn originals with photo-reproduction materials and techniques. "A Picture is Worth 1,000 Lines" describes the value of photographs in presenting details and saving drafting time, particularly in plant and facility drawings. "From Bored to Board Time" is a review of the ways in which Kodagraph films and papers can be used to simplify drawing revision. "Reproduction Room Confidential—An Exposure" presents a dramatic advance in wash-off films providing a fast, easy means of producing high-quality, long lasting duplicate originals.

The road show is scheduled for 7:30 to 9:30 p.m. at the 1200 Beacon Street Hotel, Boston, October 2; Hotel Sheraton-Atlantic, New York City, October 4, 5; Hotel Sheraton, Philadelphia, October 10; Kodak's Pacific Northern Sales Division, San Francisco, November 28; and Statler-Hilton Hotel, Los Angeles, November 30.

Readers who wish to obtain invitations to attend this road show should contact their local Kodak representative or write Gorham Parks, Graphic Reproduction Div., Eastman Kodak Co., 343 State St., Rochester 4, N. Y.

Associate Editor

WILLIAM S. HUTCHINSON, an Associate Editor of *Graphic Science*, and the author of the series of articles on Military Engineering Documentation, suffered a heart attack while on vacation in Cape Cod. He is making a good recovery and we hope to see him in these pages again soon.

Free Subscriptions Available

GRAPHIC SCIENCE is expanding its circulation. If you know someone who would benefit from its valuable and informative articles, give him the "Application for a Free Subscription" bound inside the back cover of this issue. If this form is missing, have him write Circulation Dept., Graphic Science, Wilton, Conn., and ask for a copy of the application.

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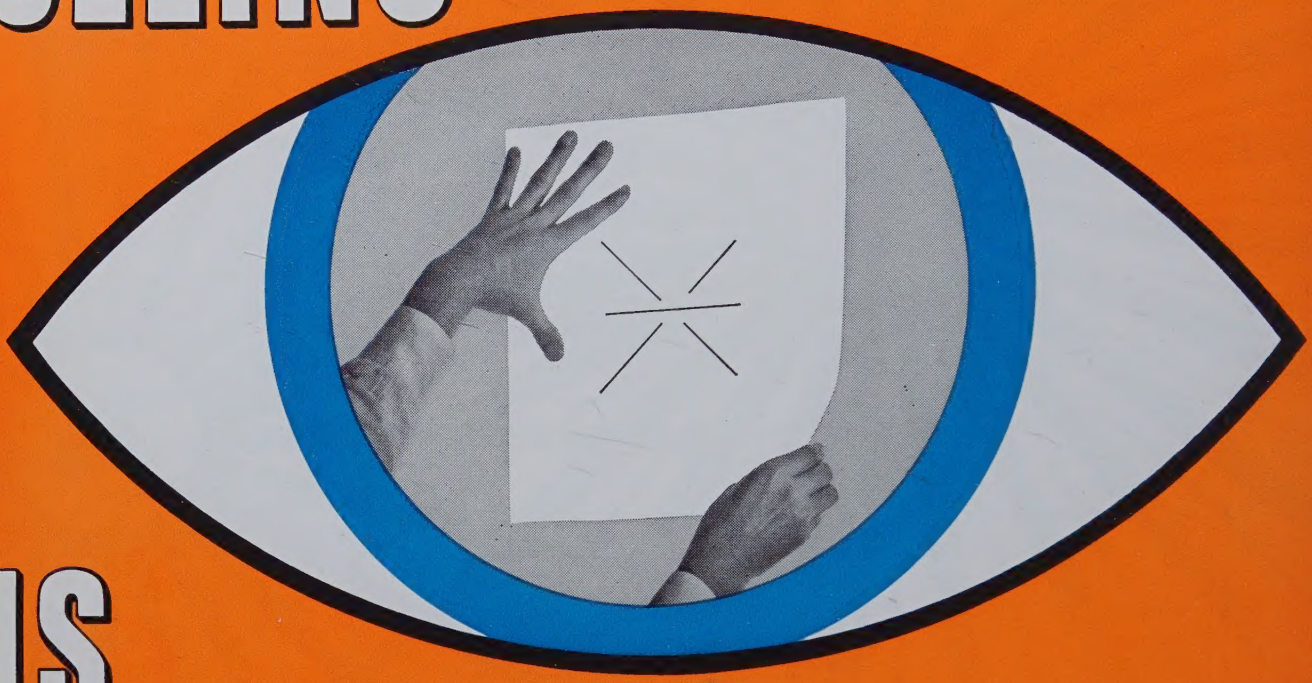

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Cost Control in the Drafting Room

What every young draftsman should know

by E. R. Wattsjer

DRAFTING can be defined as the art of recording engineering ideas in terms of specifications on drawings and bills of material. It is the bridge of communication between engineering imagination and reality. Imagination is boundless, but the reality of competitive achievement is governed by economics. Product prices largely determine competitive position and profit, and these prices are based largely upon the cost of operations and inventory involved in the production and marketing of salable products.

Since drawings and bills of material determine operational and inventory requirements, they also determine the basic costs involved. Cost control, therefore, becomes an important part of drafting operations. Product prices are also influenced by the cost of drafting operations. It is important, therefore, that these costs be kept at a minimum, but never at the expense of succeeding recurrent operations either within the engineering department or outside it. Initial drafting costs which avoid, eliminate, standardize, reduce, or simplify succeeding recurrent operations of any kind are always completely justified. They represent a profitable investment in terms of point-of-origin cost control.

Point-of-origin control is before-the-fact control. It may be defined simply as the art of anticipating and avoiding unjustified operations and inventory. It becomes a challenge to engineering initiative in attaining desired end results at the least possible cost. It is particularly challenging because of the great number of normally intangible costs involved.

Such costs are sometimes difficult to avoid, because they are often inadvertently introduced as a result of expediency measures temporarily employed to relieve specific drafting work loads or drafting costs in general. Although often recognized separately after the fact, as they occur, they are not recorded for everyone to see. As a result, they are seldom properly evaluated and recognized as a serious cost problem.

The most glaring examples, of course, can be evaluated after the fact in terms of scrap or rework charges against the engineering budget. Others can be partially evaluated in terms of engineering change paperwork costs. However, the great majority of these costs are hidden in the total costs of a variety of recurrent procurement, production, warehousing, and service operations.

All operations become involved with normally intangible costs. Department supervisors can exercise control only over those which are not inherited from previous operations. Operational costs outside engineering are determined by the condition in which paper tools and materials are received and the condition in which they are delivered to the next operation. When quality standards are maintained at both points, the recurrent operations between can be standardized most economically. However, each time paperwork or material received is subject to question, intangible special handling costs result.

Each department is at least expected to attempt to process the work received, regardless of its condition, and regardless of whether it is completely justified or not. As a result, unjustified as well as justified paperwork and inventory can be partially processed and passed on to the next operation. Thus, succeeding operations are often forced to absorb a portion of the total unjustified cost involved.

The business must be started off in the right direction. Since the initial operation is endowed with the greatest potential for before-the-fact control of intangible as well as tangible costs, engineering drawings, bills of material and related paper forms assume this function of control. Such control is most effective and applicable in the following areas:

1. An uncontrolled variety of dimensional values will increase requirements for machine setups, machine and inspection tools, jigs, fixtures, and related operations. It will also discourage interchangeability of parts through uncontrolled variety of sizes, fits, and tolerances.

   Example: Taken from actual bushing inventory study.

   Arbitrary choice of numerical values.

Uncontrolled Variety in Hole Diameters		Variety Control Potential	
1.9843 1.989	→	*1.950	*2.000
*2.000 2.002 2.003 2.005 2.007	→	*2.000	
2.1094 2.125 2.127 2.130 2.135	→	*2.120	

   * A.S.A. Standard Preferred Numbers.

   Tolerances not shown also subject to control through application of preferred numbers.

2. An uncontrolled variety of inventory will tremendously increase inventory handling costs. One company, involved with three product divisions and eight product engineering departments, has estimated a normally intangible average cost of $1,500 each time a new item in common usage is introduced into inventory. Once introduced, such parts, whether completely justified or not, perpetuate recurrent inventory handling costs as long as machine and repair order requirements last.

   As a simple example, four different bushings, identical except for length, now appear in warehouse inventory. Lengths are 2 15/32", 2 1/2", 2 17/32", and 2 9/16", respectively. It is reasonable to assume that design adjustments could have been made before the fact to eliminate two or more of the inventory handling costs involved.

3. Uncontrolled drawings, bills of material, and related engineering paper forms are uncontrolled communication tools, recurrently applied to a variety of recurrent operations involving many different personalities in different departments. Errors, incompleteness, and deviation from standard engineering records procedures of any kind always introduce numerous intangibles which can be recognized only after the fact in terms of scrap or rework; duplication of effort, special handling of paper work or inventory; delay in procurement, production, assembly or shipment; wrong or defective parts shipped; inadequacy of service literatures and engineering change paperwork.

   The drafting room must accept complete responsibility for any of the above costs which either directly or indirectly result from justified misunderstanding of engineering communications.

   For example: As a result of informal engineering change communication, the right people in production control are unaware of a change in a part. The assembly man discovers that it will not fit. Ten production machines are involved, three of them nearly completed and scheduled for shipment within a week. The wrong part has been purchased in a quantity of fifty for reasons of economy. Perhaps a total of four or five costly man-hours are wasted by shop, production, and engineering personnel in investigation and solution of the problem. Rework is impossible, since the part was complicated enough to be purchased finished in the first place. Fifty costly parts are scrapped, shipment is delayed several weeks, and overtime premiums must be paid to speed procurement of new parts and get the machines out of the way.

4. Uncontrolled dimensioning procedures introduce numerous costly intangibles, particularly at assembly. The structural fabricator and machinist is ordinarily unfamiliar with dimensional relationship between important points and surfaces in the assembly. As a result, he cannot be held entirely responsible for inaccuracies resulting from accumulated tolerances unless shop measurement sequence is determined for him. All parts should be dimensioned so that sequence of shop measurement is clearly indicated on the drawing in accordance with datum dimensioning principles.

The before-the-fact cost control function of drawings, bills of material, and related engineering paperwork is automatically satisfied when the following questions are satisfactorily answered on a day-by-day basis during drafting operations. They are the daily dozen which insure healthy economy of any enterprise engaged in the manufacture of parts which it itself engineers.

1. Are specifications accurate, complete and clear?
2. Are dimensions in accordance with Preferred Numbers Standards?
3. Are dimensions and tolerances most economical and shown to indicate shop measurement sequence?
4. Are all parts properly numbered and classified?
5. Has proper consideration been given to application of existing inventory, pre-engineered designs, and standard parts?
6. Has proper consideration been given to application of existing machine tools, jigs, fixtures, and inspection tools?
7. Are all drawings and bills of material in accordance with standard drafting practice?
8. Is all of the related engineering record paperwork in accordance with standard procedures?
9. Do they provide for all warehousing and service requirements?
10. Do these paper tools introduce any new special operation, tool, or piece of inventory which is not completely justified?
11. Do these paper tools tend to invite recurrent question or recurrent special handling inside or outside of the engineering department?
12. Has any initial drafting operation been neglected or avoided at the expense of recurrent operations inside or outside of the engineering department?

There is nothing new or original about functional drafting. It is the basic principle upon which A.S.A. Drafting Standards are built. A drawing completely satisfies functional requirements when it is able to do the job for which it is intended without being subject to functional question by anyone qualified to become involved in its use. It is said to satisfy minimum functional requirements when no engineering costs are involved in its initial production over and above those actually required to avoid functional question.

Functional drafting has recently received a great amount of publicity. Subsequent interest and popularity is perhaps partly due to misinterpretation in terms of simplified drafting. The term "simplified drafting" is particularly attractive to those who hold the purse strings because drafting costs are out in the open where they can be seen by everyone. However, the term "functional drafting" clearly implies simplification only to that point where functional requirements are adversely affected by further simplification. It is important, therefore, that simplification be governed accordingly.

Any conflict with A.S.A. Standards, if such a conflict exists, is simply a difference of opinion as to what the minimum functional requirements of a drawing actually are. This depends a great deal upon the nature of the enterprise involved, as well as upon the qualifications of the great variety of personalities who are expected to interpret the drawings economically.

For example, it is reasonable to assume that companies involved exclusively in engineering activities are perhaps less interested in controlling costs outside of engineering than those which manufacture as well as engineer their products. As a result, certain control features may be omitted from their minimum functional drafting requirements. Unjustified costs which result from a lack of this control become the responsibility of the subcontractor. The customer ends up paying the bill. On the other hand, companies which manufacture the parts they engineer are likely to be a great deal more interested in controlling the over-all cost of the end product.

It is evident that it is as important now as it ever has been for all companies to take a good look periodically at current minimum functional requirements. These are always subject to change as a result of natural evolution in the art of drafting. Much can be done in the way of simplification if this simplification is augmented by a suitable educational program to teach all of the people involved how to read drastically simplified drawings.

Every effort has been made by the A.S.A. to reflect universally recognized, time-honored simplified drafting practices. Many different practices, although in substantial use in some segments of industry, have been omitted to avoid every possible objection that might compromise national approval and acceptance of these standards.

The practical approach, is to supplement the provisions of A.S.A. Standard Practices with a degree of simplification discreetly decided upon in accordance with current company, vendor, and customer requirements, and in keeping with the principles of point-of-origin control of the intangible as well as tangible costs herein described. In cases where minimum functional requirements are subject to question, it is perhaps always most practical to determine the initial drafting cost in favor of point-of-origin control.

Sometimes security can be temporarily preserved by borrowing from Peter to pay Paul. However, the status quo cannot be maintained by borrowing pennies from Peter in order to pay Paul in dollars. This is exactly what happens when the cost of drafting operations is reduced at the expense of point-of-origin control.

The Author

E. R. Wattsjer has had approximately 43 years of engineering experience. He has been in turn a draftsman, a designer, a chief draftsman, administrative engineer, and chief standardization engineer, which latter post he now holds with the Joy Manufacturing Company of Franklin, Pa. Despite this impressive background, Mr. Wattsjer did not set out in life to be a draftsman. His early inclination was toward music, and he may possibly be the only chief standardization engineer in the world who once played the violin in a silent movie theater.

He started at Joy Manufacturing Co. in 1938 as a designer, and among his accomplishments he can count the setting up of an Engineering Standards Department and the writing of the company's Engineering Manual.

Cost Considerations in Technical Illustration

Technical illustration need not be expensive, but holding the line on costs involves many skills and techniques

by Francis F. Peters

No one will deny that the number of dollars involved in producing technical illustrations can be considerable. As a matter of fact, the entire graphic art portion of a technical publication task often costs as much as sixty percent of the effort. But for furthering the company image, replacing text, adding interest and information, or for sheer eye-catching appeal, the cost may turn out to be the biggest of bargains.

At Sylvania's Buffalo operations, we have found a number of methods to shave illustrating costs in order to make fullest use of this vital medium of communication.

Education Pays Off

The key to realistic and competitive costs for technical artwork is a complete understanding of the processes involved. When both the writer and the artist are fully aware of their responsibility as it relates to graphics production, the result cannot but reflect a sizable saving in cost. We seize upon every opportunity to spread the word about illustrating, photography, retouching, printing, and publication project management with this motive in mind. The first thing necessary in cost cutting is the hiring and/or training of knowledgeable personnel.

First Things First

Acquiring suitable candidates ordinarily starts in our personnel department. The use of comprehensive job descriptions prepared by the art or publication supervisors facilitates a judicious screening of applicants. With a preselected group to choose from, personal interviewing plus scrutinizing of portfolios ends in selection of the best of available candidates.

At Sylvania, a great deal of emphasis is placed on personal coaching by qualified experts. This grassroots approach to instruction has much to be said for it since a close evaluation of native talent can be made and the talent directed as need requires. Instruction is continuous and periodic performance reviews held with the employee's immediate supervisor show the progress, or lack of it, as measured against the employee's job description. Along with the obvious educational benefits to the individual, the company also gains by the tailoring of another member to the team. Though the molding process of team members is the prime objective of the educational program, individuals are encouraged to express their personal views and to advance new ideas, methods, use of materials, and procedures that will further the at-

tainment of the group's goal. That goal is to improve quality and reduce the cost of technical illustrating.

Still More Education

Coupled with personal coaching, periodic tutorial seminars are held on such diverse subjects as printing, photography, English grammar, planning, scheduling, illustrating, subcontracting, standards, and the use of government specifications. In addition, a limited program of job rotation and instructional visits to allied services have been instituted with gratifying results. By being exposed to processes, procedures, and people in areas through which their work must pass on its way to completion, personnel gain a better insight of how they must perform. The advantage is most pronounced in the area of scheduling, where understanding of equipment capabilities, size limitations, material pecularities, and numerical output per unit aids in realistic planning for timely completion.

What, When, Who, and How?

Assuming all interested parties are on board with the fundamentals. the next largest area of improvement is in planning and scheduling of the task itself. In every instance, we ask three basic questions:

1. What is the scope of the job?
2. When is it to be accomplished?
3. Who is going to do it and how?

Determining the Size of the Task

Over-all responsibility for a publication invariably lies with our writers. If the task is a handbook, the governing specification and contract must first be gleaned for all mandatory requirements and deviations. Using this information the writer determines the type, nature, mix, and quantity of illustrations needed to adequately illustrate the text. Working with an outline and using samples of manuals published on similar equipment, he gages his needs by applying parts density factors along with possible past experience. A lot of words can be saved by choosing the illustrations first.

In the electronics business, with great inroads being made in the areas of microminiaturization and modular construction, complex mechanical devices have for the most part been eliminated. With the need for mechanical exploded views at a minimum, parts identification and relationships are generally accomplished photographically. The line artwork portion normally consists of the wiring, schematic, and functional block diagrams. After grouping the required illustrations into arbitrary categories such as simple, average, and complex, the time in hours is assigned for the art and photography effort.

Planning and Scheduling

With the art and photography requirements determined, the writer begins his scheduling. Working from both ends of the time scale, and accepting some rigid lead times advanced by the graphics production and printing groups, he establishes manpower loadings for the entire publications effort.

Next comes the question of who is going to do it, and how. In a field as complex as technical publications, there is a wide variety of talents which must be conscientiously considered for best results.

A Team Effort

Where there is art, there must be artists. It is essential that they be fully apprised of the entire task since they become involved in illustrating, drafting, and production as well as coordinating with photographers, printers, typists, writers, engineers, and part catalogers. We give each of the others in turn ample notice of their contribution so that our writer may gain by sharing in their experience and knowledge of past jobs.

Each contributor to the end result (the printed publication) is looked upon as an expert in his field, and well he should be. The owner of the box camera is in no position to direct the operation of a 31-inch process camera and the printer is certainly the only qualified person to judge from what form he can best process a halftone negative. Each member of the expert team must understand what his responsibility is and how it relates to the responsibilities of other team members. Then cost cutting begins in earnest.

Ways and Means

For example, if the draftsman is made aware of the required result in accordance with the applicable specification, he may be able to adjust and modify his usual practice to fulfill sufficiently the requirements with minimal increased effort. Often it is only the line weights and lettering size that stand between a pickup and a redrawing program. With proper direction, countless hours can be saved with little or no loss of quality and usability. Layout of the drawing in proportion to the specified format is also important since reduction to the printed-page size assures full use of the available area.

We avoid costly fold-outs whenever possible. Breaking the drawing down to functional sections with bridging notations is often the simplest solution to this problem. Where specification requirements call for modification of standard drafting practice in such instances as the addition of waveforms, notes, references, and road map coordinates for locating parts, we apply photographic processes to pick up usable portions and add the rest as an illustration task.

A close working relationship with the photography department cannot be overemphasized. The days of large-production contracts are on their way out in the fast-moving electronic technology of today. Greatest emphasis is now being placed on research and development. The most efficient available means to record changes is the camera. As in all creative activity, a photograph does not just happen. It must be adequately planned for. It is again our writer's task to define the need that the picture must fulfill, arrange with engineering for the availability of the proper equipment to be photographed, provide for transportation, and schedule the shooting time with photography. Either he is present or he leaves adequate instructions to assure required photographic coverage.

Our writer also makes the decision with the help of the graphic arts department on whether it would be less costly to retouch minor changes into existing photographs rather than to reshoot. Decisions of this nature are only made as the situation presents itself and no hard-and-fast rules are set down in advance. Good timing in

getting the hardware in front of the camera pays off in time saved and subsequent lower cost. The number of photographs required to do the job is gaged by the reasonable number of parts that can be effectively shown and identified in one illustration. Upper limits of from 30 to 40 pieces per picture are kept in mind.

The parts cataloger working with engineering or factory drawings is usually in the best position to suggest logical parts breakdown by function and physical relation. We often use his marked-up prints to direct photography, and in some instances where the time or difficulty of disassembly may preclude use of photos, we find his working prints the most comprehensive information available to illustrate the parts in line.

Substantial savings may be possible in the area of reproduction when the printing department or other reproducing service is made fully aware of the requirements. Quantity break-off points and varying need for quality will determine the best means of coming up with multiple copies. In any event, sound graphic arts practice requires an absolute consistency of sizing and identification for ease of processing, as well as orderly submission of material. To assure expedient handling, we have established a minimum order number and we adhere to it. We prorate processing time by assembly-line procedures since costs rise sharply with individual or spotty handling requirements.

Further Ways and Means

In its focal role for producing technical illustrations, our graphic arts department is in the most favorable position to trim costs. A prime requisite for an effective control to this end is to log incoming artwork and maintain its status record by figure number and title through all production phases. This procedure eliminates loss, keeps a current status record, aids in future pricing information, and assures orderly and time-saving processing of the art. The log contains blanks for:

1. Name of the publication.
2. Name of the writer in charge.
3. Number of applicable specifications, if any.
4. Figure number.
5. Title.
6. Security classification, if any.
7. Submission, check and completion dates.
8. Type of illustration (continuous tone or line).
9. Planned reproduction size of illustration and format.
10. Remarks.

Acting as a conscience on all requests for illustrating tasks, our artists pose a number of leading questions to the writer and allied service groups. Is the illustration really necessary? Could it be eliminated or combined with another? Has it been reduced to its smallest practicable size? Have unessential details been eliminated? Can a less expensive photograph be used in lieu of line art? Is color really necessary or can coding be used to replace it? Has every attempt been made to reduce the number of combination line and halftone illustrations? Must the art be so decorative? These and other provocative questions are necessary to insure lowest possible illustrating costs.

On their own initiative our artists insist upon using only those clear, well-lit photographs which will need minimum retouching for good offset reproduction. For display headings and nomenclature, we prefer typeset composition rather than hand or mechanical lettering. We make full use of available artists' aids and we set aside proper storage areas for uncluttered, clean, and accessible storage of expensive artwork. We use materials of the best available quality, since these are generally more durable, longer lasting, and easier to work with. And finally, we make a conscious effort to establish and maintain pleasant working arrangements with those who use art service. Informality is our keynote. When established, it pays off in better quality and increased production.

Don't Work in a Vacuum

Contacts with engineering on illustrating matters are ordinarily made through the writer or in some cases directly, with his awareness. At least two checks of all artwork are made: the first when the art is in preliminary or rough form and the second upon completion. Since technical accuracy is of prime importance, neither of these checks can be overlooked. Advice from the source in a fast-paced program can often save many hours of misdirected effort. We establish close cooperation with engineering groups on the basis of our mutual needs. Operational, maintenance, and parts breakdown manuals are usually developed as a result of contractual requirements to support the hardware. Since it is judged on how well the finished equipment can be serviced and repaired as well as on how it operates, engineering must take time to check the art conscientiously for usability and accuracy.

In a Nutshell

Holding the line on technical illustrating costs is then no simple clear-cut problem. It involves many skills and techniques peculiar to the publication field as well as many time-worn practices applicable to any business function. Well trained personnel can be considered of prime importance, coupled with sound illustrating practices and attention to detail. Scheduling and planning comes next to insure orderly execution and timely completion. Lastly, a good working relation between all of the functions involved must be established and maintained.

Admittedly, some of the above-mentioned suggestions will be difficult if not impossible to institute and administer in every organization. We at the Sylvania's Buffalo operations have put them into gradual effect with excellent results. Each separate procedure showed measured improvement as it was introduced over a three-year period. A cost saving of 15% over our previous methods has allowed us to remain competitive and show a profit. In addition, our quality of product, professional attitude, and skills have also improved. We hope it can do the same for others.

The Author

Francis S. Peters received his Bachelor of Fine Arts degree from the University of Buffalo and the Albright Art School in 1951. He has been a mechanical draftsman, technical illustrator, and art director in the technical publications field, and is now Supervisor of Graphic Arts at the Amherst Laboratories of the Electronic Systems division of Sylvania Electric Products Inc.

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Drawing Titles According to MIL-STD-28

The present rules for composing drawing titles are confusing, difficult, and result in unreasonably long titles — here is a practical solution to the problem

by R. L. Mortimer

1. FLANGE, FRONT COMPRESSOR FRONT CASE FRONT DUCT—REAR

2. FLANGE, FRONT COMPRESSOR FRONT CASE FRONT DUCT—FRONT

3. STIFFENER, DIFFUSER SECTION FAN DUCT REAR STRUT—OUTER RIGHT REAR

4. STIFFENER, DIFFUSER SECTION FAN DUCT REAR STRUT—OUTER LEFT REAR

THE FOREGOING titles may seem ridiculously long, confusing, and without reason but they have been concocted by following the rules in MIL-STD-28. ANA Bulletin No. 411a which was superseded by MIL-STD-28 had similar rules.

Paragraph 1.1 indicates these rules apply "for all drawings and parts detailed thereon." Paragraph 3.1 requires that drawing titles contain "sufficient modifiers to differentiate like items in the same major assembly," paragraph 4.2.4 says titles shall "distinguish between similar parts," and paragraph 5.2.1 states "When two or more drawings are similar, and the parts detailed on them perform the same general function, they shall be distinguished by additional modifiers indicating their location, relative position, forms, dimensions, etc." This does not apply to standard parts which are excepted by paragraph 5.2.2.7.

As can be concluded from the rules quoted from MIL-STD-28, all parts on any major assembly shall have different titles, except for standard parts.

There are times when a conscientious person finds these rules very difficult to follow for items that are not permanently assembled. For permanently assembled items, such as nonstockable details of a weldment, they are even more difficult to apply and at times seem quite impractical. For instance, although a weldment is generally considered nonreparable (and its details nonstockable), separate drawings are sometimes made for the details. Where this is done, it is merely to facilitate scheduling of production and to simplify the drawing and dimensioning problems. In this case, drawing titles on the details are for "in-house" use and appear to be of no real use to the government. This position seems borne out by the fact that the government appears to get along very well without titles for details in the frequently used practice of making a "self-contained" weldment drawing on which is included all detail information without benefit of detail drawings, detail part numbers, or detail titles. Therefore, where a nonstockable detail drawing is made, it seems logical to identify it by applying an appropriate noun and simply modifying it with the name of the weldment, even where this results in duplication of titles. Using this reasoning the titles previously shown would now become:

1. FLANGE, FRONT COMPRESSOR DUCT
2. FLANGE, FRONT COMPRESSOR DUCT
3. STIFFENER, DIFFUSER SECTION FAN DUCT
4. STIFFENER, DIFFUSER SECTION FAN DUCT

If you wonder why more people have not complained about the rules in MIL-STD-28, a study of existing drawing titles would quickly give you the answer. From the titles on most manufacturers' drawings it would seem that the people who assign drawing titles are not aware of the rules. Most titles of stockable items are too short, often one word: (FITTING; ADAPTER). Even where they are longer, they frequently fail to differentiate between similar stockable items in the same assembly.

A closer look at the situation may reveal some of the reasons for not following MIL-STD-28. Practically all manufacturers allow almost anyone to assign drawing titles for new items. At first, this may appear to be the simplest and least expensive arrangement, but it is the road to inconsistency and to non-MIL-STD-28 titles. Even nomenclaturists with years of experience, who are trained in the use of MIL-STD-28, have great difficulty maintaining consistency without the use of a guide or manual specifically covering their own product. Probably the most common reason why manufacturers do not follow their government contractual obligations, in MIL-STD-28, is that this would serve no purpose for them—especially since the rules are next to impossible for the government to police. Thus, many manufacturers simply do not educate their people to follow the rules.

Frankly, what purpose is served in differentiating by title all items (except hardware) that occur in the same major assembly? Apparently it is not too important; otherwise, some effort would have been made to enforce the rules, and we have never heard of any such effort. If it is true that it serves no real purpose, why not realistically change the rules so that conscientious manufacturers are not burdened with work that more casual ones now avoid for a result that the government does not need or really desire?

We do not mean to shorten the title so that it would be useless for government cataloging and standardization purposes. A minimum title would do—one that complies with Cataloging Handbook H6-1 or, for a non-H6-1 item, a title that compares with similar items in H6-1. This kind of title serves a very good purpose. It allows the government to take the first step in cutting inventories to a minimum, to compare like items, and to combine, under one Federal Stock Number, items that are physically and functionally interchangeable.

A practical drawing title would be one that serves a useful purpose to both the customer and the manufacturer. This purpose would be to establish a common nomenclature or language for any given item (BOLT, MACHINE; SCREW, MACHINE; SCREW, CAP, HEXAGON HEAD; SCREW, CAP, SOCKET HEAD), which is the first step in any standardization program. Such a step would tend to eliminate the same item being called many different names and, thus, reduce confusion in paperwork and talk. To do this, the title must be consistent not only with other similar items made by the same manufacturer but, preferably, with all other similar items. A great step was made in nomenclature standardization by the government when it published Federal Cataloging Handbook H6-1. It may not be utopia for drawing nomenclature, but it is a good solid start and certainly the largest and best undertaking of this sort ever made.

More titling than that shown in H6-1 or, for non-H6-1 items, more than enough to segregate major differences between like items, would seem to be of no great help to the government. Apparently the government should revise its rules to allow the manufacturer to use the minimum (on H6-1 title) if that is all he requires; e.g., GASKET. However, if the manufacturer needs a more explicit title the rules should allow him to add modifiers (using MIL-STD-28 order); e.g., GASKET—CORK. This may be enough for some manufacturers but others may desire more complete titles for control purposes; e.g., GASKET—CORK, ¼ VALVE or GASKET—CORK, ¼ VALVE, UPPER. Then those who follow the rules would save a lot of useless work, and those who have not been following them would find them a lot more reasonable, and would be more likely to use them in the future.

The Author

R. L. MORTIMER has been the supervisor of the Federal Cataloging Group of Pratt and Whitney Aircraft, East Hartford, Conn., for the past three years. A graduate of Pennsylvania State University, he holds a degree in Mechanical Engineering.

Application of Graphics to Engineering Design Problems

Some challenging examples of how graphics are used in the practical solution of engineering problems

by P. G. Belitsos

GRAPHICS OF MULTIPLANE RIGID METAL TUBES FOR JET ENGINES

Part III of a Series

A CONSIDERABLE portion of the engineering effort that goes into the design of an aircraft turbojet engine is devoted to the engine control systems.

With the design and development of each new model engine there is an increased demand for more and more automatic features in the controls. This demand comes jointly from the airplane manufacturer and the engine manufacturer both of whom are concerned with providing these automatic features in order:

a) to permit the pilot greater ease in controlling the engine during flight;

b) to obtain maximum operating efficiencies from the engine;

c) to protect the engine from unintentional abuse that would detract from its usefulness; and

d) to provide operational safety during any emergency conditions that might arise.

In conjunction with these engine controls and accessories, there is a large complex of flexible hoses and metal tubes required to transmit the fuel, oil, water, alcohol, air, and other mediums to various points of the engine and the airframe. The design layout and development of the multiplane metal tubes present some interesting problems in engineering graphics which we will analyze in detail. For many years graphical methods have been used to develop these multiplane tubes from design conception to final engineering details drawings. These graphical methods involve some rather complicated orthographic projection and the application of many of the principles covered by descriptive geometry. In recent years engineering graphics has joined forces with a mathematical programming of the elements of tube design using electronic data processing equipment. This has resulted in significant advances.

Design Considerations

IN THE design layout of tubes it is important that they be routed so as:

a) to require the shortest length of tube to connect the input and output ports in the engine;

b) to bypass or clear any obstacles in its path and yet maintain the maximum simplicity in the geometry of the tube;

c) to be compact and lie as close as possible to the basic engine in order to maintain the minimum envelope for the over-all engine; and

d) to allow for ease of assembly and maintenance.

Before going into a detailed graphical analysis of these multiplane tubes, let us look at some actual photos depicting the external configuration of some aircraft jet engines (see Figs. 1 and 2). These photographs give an indication of the complexity involved in the routing of these multiplane tubes and the extent to which they are used on aerospace propulsion equipment.

Elements of Multiplane Tubes

IN ESTABLISHING the configuration of any multiplane tube, four basic elements are used which are shown in Fig. 3 and defined as follows:

1. Straight Length. The straight length of tube from an end point to a tangent point of an adjacent bend or the straight length between the points of tangency of two adjacent bends.
2. Bend Angle. The angle through which the tube is bent in a single plane at any given bend.
3. Bend Radius. The radius of curvature of the bend. It is usually specified to the axis of the tube.
4. Angle of Rotation. The included angle between the planes of two adjacent bend angles. The planes intersect in a straight line that is coincident with the axis of the straight length of tube which is common to both bend angles. The angles of rotation (also known as the twist angle or turntable angle) is given when looking down this straight line towards the previous bend and is measured counterclockwise from the plane formed by the previous bend angle.

This paper was presented at the Summer Conference on Graphics in Scientific Engineering held at the University of Detroit, July 18, 1960 by the National Science Foundation.

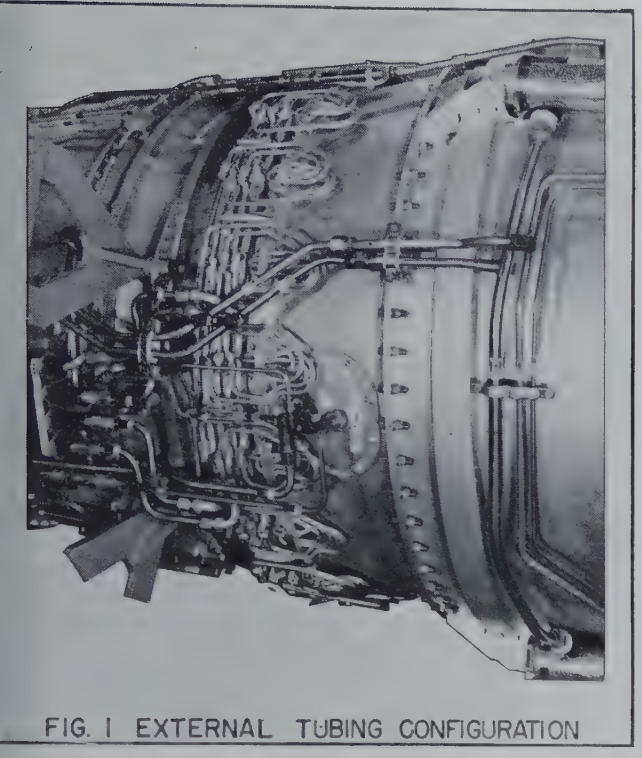


FIG. 1 EXTERNAL TUBING CONFIGURATION

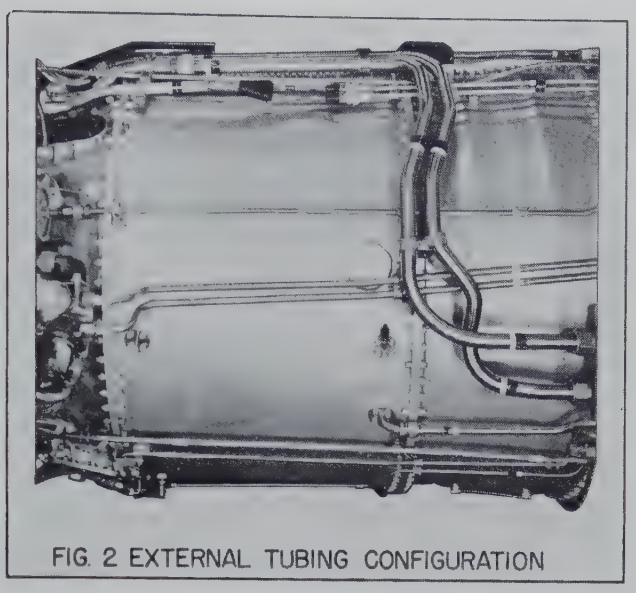


FIG. 2 EXTERNAL TUBING CONFIGURATION

Types of Views

The graphical method used to establish the design configuration of multiplane tubes involves use of the views illustrated in Fig. 4:

Principal Views. Two principle views of the tube, such as the front and side views, or front and top views, are shown. These views are selected so that one plane of the tube is in the plane of the paper on which the graphical representation is being delineated.

The selection of these principal views is intended to show clearly the general contours of the tube; that is, each bend is represented by a curved line in at least one of the two views selected. In each view, the axes of adjacent straights are extended to form intersections which are emphasized by dots and identified as A, B, C, etc.

Bending Information Views. After the principal views are completed, a series of auxiliary views are drawn showing alternately the angle of rotation views and bend views. These views repeat the identified intersecting points established in the main views.

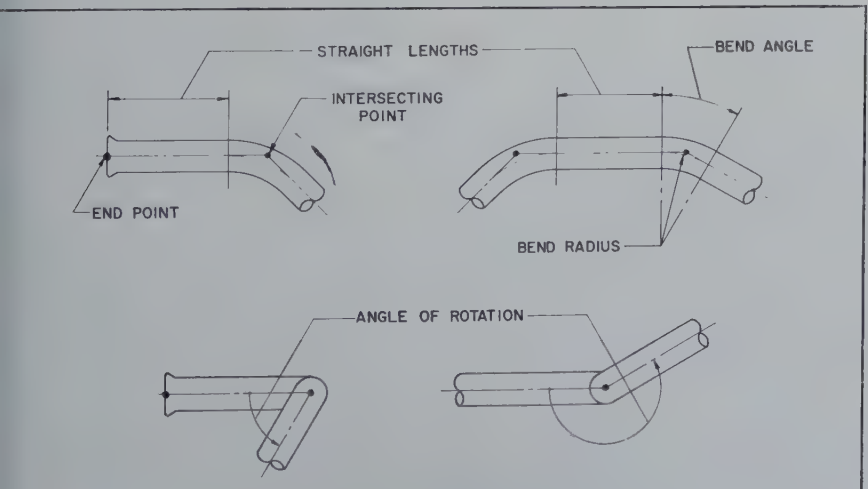


FIG. 3
TUBE BEND TERMINOLOGY

Angle of Rotation Views. An angle of rotation view is one that shows a group of three adjacent straight portions of the tube connected by two bends in different planes. It is drawn so the middle straight length is perpendicular to the drawing surface.

Bend Views. A bend view is one which shows a true (circular-arc) view of a bend; that is, the plane of the bend is parallel to the view. Two or more bends are shown and dimensioned in a single view if they occupy the same plane.

Intermediate View. It is sometimes necessary to provide an intermediate view in order to establish the proper relationship between the bend-information views and the main views. An intermediate view is one which is drawn between one of the main views and the first view of a series of bend–information views. Its purpose is to bridge the projection between the main views and the bending views. It is used only when all intermediate straights are foreshortened (lie in oblique planes) in both of the main views. It is projected normal to one of the intermediate straights in the main views, to show the straight in its true length so that bend information views may follow as progressive projections. It usually carries no dimensions.

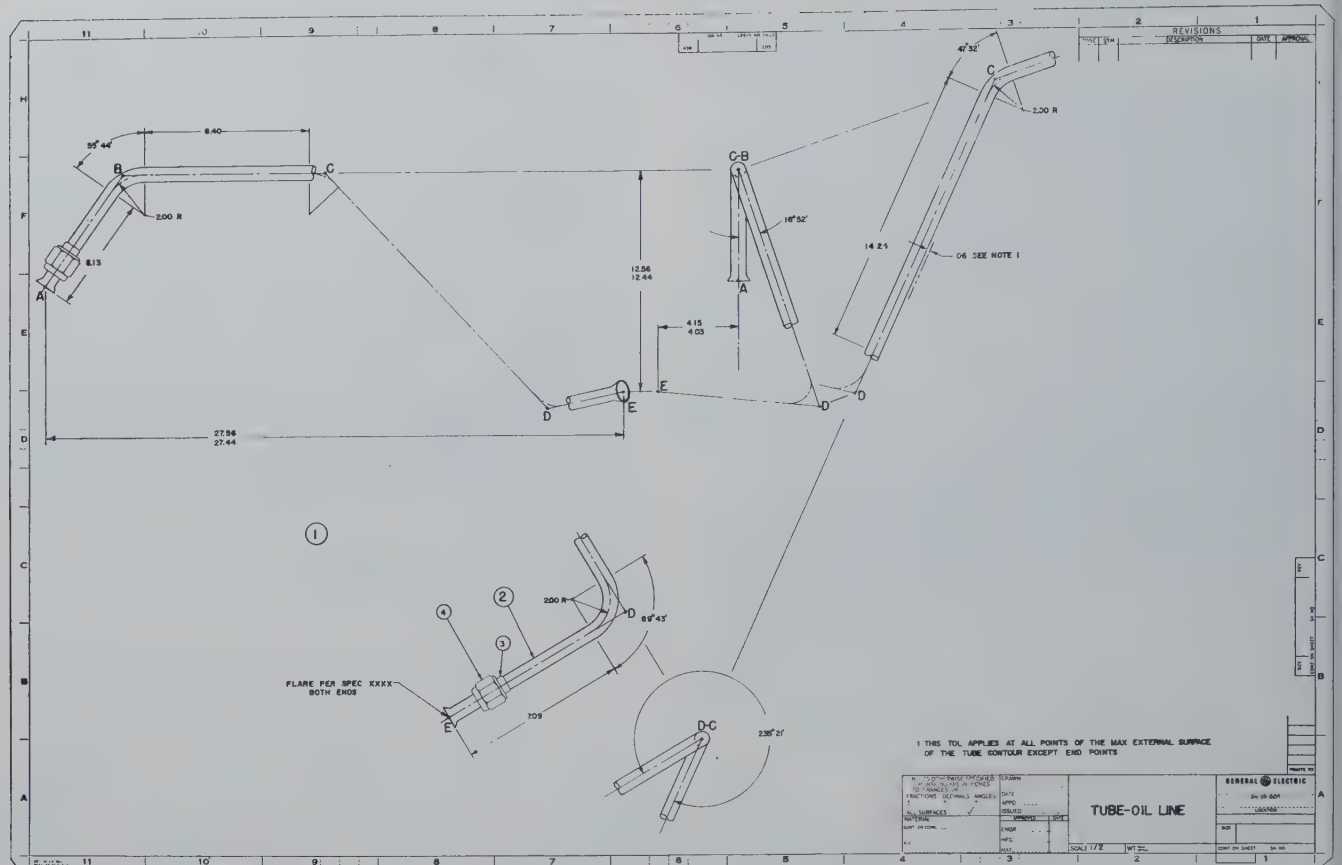


FIG 4 DETAIL DRAWING OF TUBE (OLD METHOD)

Analysis of Graphical Method

Now that we have reviewed the four basic elements of a tube and described the types of views we will analyze a simple multiplane rigid tube which has been bent so that its basic axis is in three planes. Let us follow through step by step the complete definition of the relatively simple tube shown in Fig. 4.

1. In the front view the straight length 6.13, bend angle 55°-44′, and straight length 8.40, are in the plane of the paper and can be dimensioned directly.
2. In the side view the angle of rotation 18°52′ is given between the planes of the first two adjacent bend angles. As can be seen, the angle of rotation is given when looking down the straight length which is common to both bend angles and towards the previous bend. Also the angle of rotation is measured counterclockwise from the plane formed by the previous bend angles.
3. In the auxiliary view, which is projected perpendicular to the second plane, we can now construct the next true bend angle, radius, and straight length.
4. These steps are repeated until all the true straight lengths, bends, and angles of rotation have been developed.

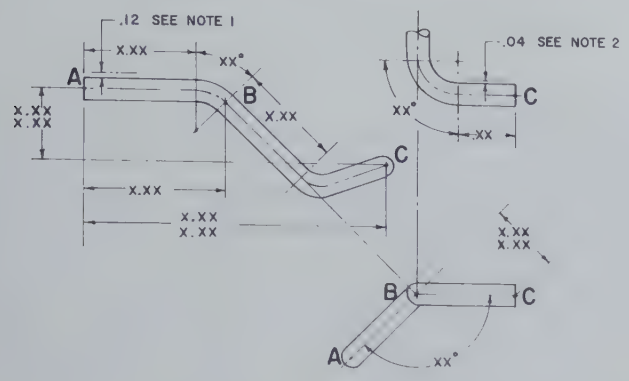
Control of Tube Contour and End Points

You will note that the ends of the tube are located in three mutually perpendicular planes by toleranced coordinates. This controls the location of these end points so that the tube will fit properly in its intended application at assembly. These toleranced coordinates are specified on tubes that are sufficiently rigid in the free state so that proper assembly to the mating parts depends upon the fixed relation between these end points.

The configuration of the tube is established by a series of basic untoleranced dimensions for the straight lengths, bend angles, and angles of rotation as shown on this drawing. To control the variations in the contour of the tube through its length a contour zone tolerance is shown on the delineation, as in Fig. 4, and the related note is specified as follows: *'This tolerance applies at all points of the maximum external surface of the tube contour except end points*

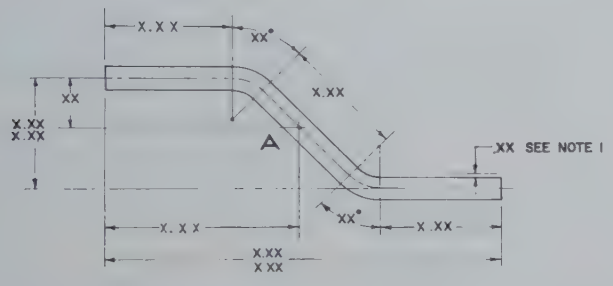
In terms of the axis of the tube this means that the axis must conform to its true shape within a .06-inch radius. In terms of the surface of the tube this means that the contour must be confined for its entire length within a uniform tolerance zone which is .06 greater in a radial direction than its true maximum material contour. This is a three-dimensional tolerance and is applicable to the entire length of the tube except at the end points. The relationship of the end points is controlled by toleranced coordinates as shown on the drawing. Any tube that falls within the envelope and meets the required end-point relationship is acceptable.

For tubing that is flexible in the free state due to its length or construction, the relationship of the end points is established by basic untoleranced dimensions. The contour



1 THIS TOL APPLIES AT ALL POINTS OF THE MAX EXTERNAL SURF OF THE TUBE CONTOUR BETWEEN A & B
2 THIS TOL APPLIES AT ALL POINTS OF THE MAX EXTERNAL SURF OF THE TUBE CONTOUR BETWEEN B & C

FIG. 5 VARIABLE CONTOUR TOLERANCE



1 THIS TOL APPLIES AT ALL POINTS OF THE MAX EXTERNAL SURF OF TUBE CONTOUR EXCEPT THAT IT MUST CONFORM TO ITS TRUE SHAPE WITHIN .YY AT A SECTION THRU POINT A

FIG. 6 CONTROL OF CRITICAL SECTION OF TUBE

zone tolerance for these nonrigid tubes is specified as follows:
This tolerance applies at all points of the maximum external surface of the tube contour with end points mounted at basic.

Special Applications

When the contour zone tolerance is not the same throughout the entire length of the tube, each portion requiring a different tolerance has its tolerance separately specified. Appropriate points on the tube centerline are chosen to segregate these portions of the tube and the tolerance notes are modified to reference these points. The following is a typical drawing note used for this purpose and its application is illustrated in Note 1 of Fig. 5:
This tolerance applies at all points on the maximum external surface of the tube contour between A and B.
The smaller contour tolerance which applies from point B to C is specified in Note 2.

When the design requirements are such that it is necessary to hold certain critical points on the tube closer than the rest of the tube, these points are labeled with appropriate letters and located by a basic dimension. The following is a typical drawing note used for this purpose and its application is illustrated in Note 1 of Fig. 6:
This tolerance applies at all points on the maximum external surface of the tube contour except that it must conform to its true shape within .YY at A section through point A.

To Be Continued

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New Products

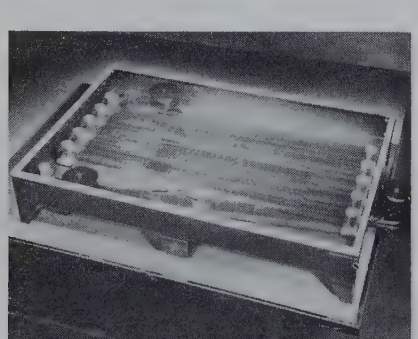
Office Copier

Copier 9 is the latest addition in the diffusion transfer field. Made by Photostat Corp., 1001 Jefferson Rd., Rochester 3, N. Y., the new machine is a natural expansion of the company's activities in the office copying area.

In the works, to be introduced shortly by Photostat, is a new microfilm reader-printer, designed for procedural microfilming applications in the engineering field.

Temperature Compensator

A light weight, portable electronic control package which changes the speed of an electric timer to compensate for temperature variations in a photographic tray or tank is now available. Manufactured by Trott Electronics, Inc., Rochester, N. Y., and distributed by Marks & Fuller, Inc., Dept. GS, 70 Scio St., Rochester 4, N. Y., the Trott Temperature Compensator is designed virtually to eliminate the variations in negative density caused by the unavoidable changes in developer temperature during the processing of black and white photographic films.



Microfilm Dryer

A new bench model microfilm dryer has been put on the market after considerable testing by a commercial microfilm processing firm. Manufactured by Porta-Trace, Inc., Dept. GS, 50 Wall St., Binghamton, N. Y., the dryer will accept a 100-foot spool of 35 mm. film; will dry it in approximately 55 minutes. Of simple design and nonrusting materials and construction, the dryer sells for $290.

C-Thru Portfolio

A new vinyl, folding portfolio which simulates calfskin and holds five drawing and drafting instruments, a drafting pad, and a pencil has recently been put on the market by C-Thru Ruler Co., Dept. GS, 827 Windsor St., Hartford, Conn. The portfolio has pockets to hold its contents, measures approximately 9½" by 13½" closed, and approximately 19" by 13½" open. The drafting instruments include: 30/60° triangle, 45/90° triangle, laminated protractor, French Curve, 12-inch calibrated T-square with inch and millimeter scales.

Redesigned Camera

The Miller-Trojan Co., Troy, Ohio, has introduced a redesigned version of its Model DC Camera. Now designated as the Model DC Action Camera, the improved model includes: a streamlined base which reduces camera height by 6" promoting greater ease and efficiency of operation; more rugged copy board with new cam-action lock, lid hinges, and counterbalanced frame lid; heavier exposing light arms for flexibility in positioning of camera lights; chain drive for focusing; tilted instrument panel.

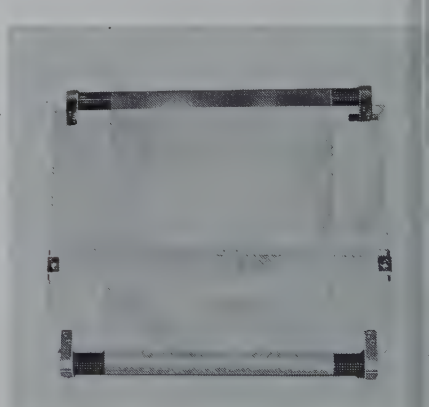
The camera is delivered as a complete, ready–to–operate package; comes in three sizes: 11" by 14", 16" by 20", and 24" by 24".

Pants Guard

To prevent draftsmen's trousers from becoming frayed by rubbing against the guard rail of the drawing board, Best Yet Products, Dept. GS, 10719 S. Rhodes, Chicago 28, Ill., has introduced an aluminum channel covered with sponge rubber. The channel slides along the guard rail as the draftsman moves from side to side. Price: $2.50 each.

Projection Drawing Machine

The Sun-Vu Projection Drawing Machine is a new mechanical means for making scalable, three-dimensional, projected technical drawings. With this machine, a few Air-Vu type drawing instruments, and the attachments, it is possible to produce isometric projections, topographical relief maps, 3-D wiring diagrams, orthographic views, flow sheets, cabinet projections, terrain models, and a multitude of other drawings or projections. Manufacturer: Air-Vu Co., Inc., Dept. GS, 530 Kalamath St., Denver 4, Colorado.



Roll-O-Draft

A drafting device in kit form designed to permit the draftsman to work more efficiently and comfortably is now available from Burmar Assoc., Dept. GS, 156 N. Franklin St., Hempstead, N. Y. In various sizes to fit all drafting surfaces, it has a continuous Mylar belt which affords mobility of work. With the Roll-O-Draft, quick transfer of drafting activity from one sheet to another is possible without removal or realignment of work.

hotodrawings on CRONAFLEX®:

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esigning advanced computer prototypes, engineers at emington Rand's Univac Division faced the problem of ansmitting complex specifications to customers and roduction facilities—many of them overseas. Needed were awings graphic enough to minimize misinterpretation, t adaptable to progressive modification and refinement.

ne solution: photodrawings on CRONAFLEX® Engineering eproduction Films. In this technique, a photographic image is sed as the main body of an engineering drawing and assembly etail is added by a draftsman. Not only does the new method ake complicated specifications easily understandable, it as already cut drafting time—and costs—drastically.

ys Theodore Warzel, Chief of Univac Division's Photographic epartment: "We actually turn out completed drawings about 5 times faster than we used to! And the excellent erasability CRONAFLEX permits numerous revisions to be made—must in critical development work—with no mage to its fine drafting surface."

sults like these are typical of the performance of RONAFLEX in situations where other materials promote ste and inefficiency by failing to fit a need exactly. To rn how these versatile films can meet your own quirements, clip and mail the coupon today.

Draftsman adds assembly detail to complete master original photo drawing. Photographic images insure accurate interpretation of data, also mean tremendous savings in time and money.

E. I. du Pont de Nemours & Co. (Inc.)
Photo Products Department GS 10
Wilmington 98, Delaware

Please send me, without obligation:
- ☐ Information on the full line of CRONAFLEX films
- ☐ Details on photodrawing technique described here

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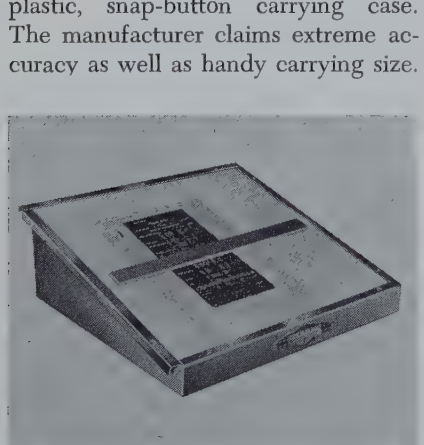
Diazo-Black Intermediate

A new diazo-black intermediate called 12T, with the visual density and contrast of black and the reproducibility equivalent of sepia, has been announced by Technifax Corp., Dept. GS, 195 Appleton St., Holyoke, Mass. 12T has a transparentized, 100% rag base, which is 10% heavier than that of conventional intermediates, offering superior handling characteristics and longer life. The company recommends it to reproduction departments which need the readability and photo-copying characteristics of a black image, as well as the opacity to ultraviolet radiation of sepia-image materials. Additional information and samples are available on request to the manufacturer.

Vest Pocket Rule

A new small-size slide rule has just been put on the market by Nobema Products Corp., 141 Greene St., New York 12, N. Y. Called The Jiffy Slide Rule, this 4" rule has the standard A-B-C1-C-D-K scales, is made of hardwood with a fine quality cursor. It is packed in a heavy transparent plastic, snap-button carrying case. The manufacturer claims extreme accuracy as well as handy carrying size.



Layout Table

The Miller-Trojan Co., Dept. GS, Troy, Ohio, is now marketing a low-cost bench model layout table called the Topper. Features include a work area 18" by 20"; stainless steel straight edges; diffusion sheet mounted under glass work surface to eliminate glare; fluorescent lighting; tilted surface for ease of operation. Miller-Trojan supplies a complete line of T-squares for use with the Topper, as well as for use with its Tilt-Top and Standard Model layout tables.

Drafting Tape Pen

A new drafting instrument for fast and accurate application of self-sticking tapes to charts, printed circuit masters, and other graphic illustrations is now on the market. Made by W. H. Brady Co., Dept. GS, 727 Glendale Ave., Milwaukee 9, Wisc., the Brady Quik Line Tape Pen saves drafting time because it requires no filling until the entire roll of tape is used. It will draw on any inkable surface and on most surfaces on which ink cannot be used. Lines are uniform in width and density, accurate for placement to .01 of an inch.

Microdensitometer

The Ansco Division of General Analine & Film Corp., 29 Charles St., Binghamton, N. Y., has introduced a new precision automatic recording microdensitometer believed to be the most compact and lowest priced of its type. Two lightweight, table-top assemblies provide measurement of density as a function of linear travel. The new Model 4, combining selective optical equipment with a versatile and accurate recording system, offers a range of capabilities previously unobtainable in one precision instrument, according to the manufacturer. In addition to already established fields of use, the new Model 4 can be utilized for miniaturized character study, analysis of solid state components, further astronomical work, blood structure research, meteorology and fallout research, electronic read-out systems, and precision inspection.

Reader-Printer

A new microfilm reader-printer, which will enlarge or reduce a projected image without loss of focus, is now available. The Filmac 300, manufactured by Minnesota Mining and Manufacturing Co., is the third reader-printer now marketed by the firm. The new unit gives additional flexibility in print size, accepts either 16 mm. or 35 mm. microfilm in roll, aperture card, jacket, or film sheet form. Two projection lenses provide magnification of 8 to 20 diameters; copies can be made in any size up to 11" x 14" in less than 10 seconds by push-button. More information on Filmac 300 can be obtained by writing Dept. Sl-271, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Film Cleaning Accessory

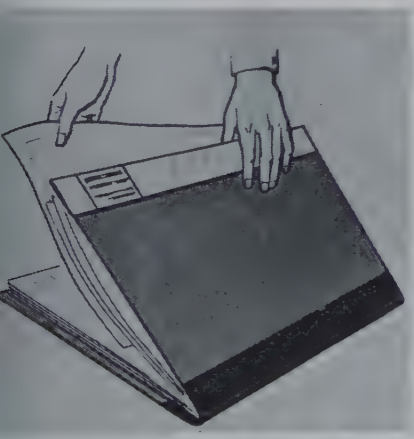
To meet a demand for high-quality, automatic processing of jet-backed microfilm, Canadian Applied Research Ltd., 750 Lawrence Ave., W., Toronto 19, Canada, has introduced an accessory for its Tri-Film Processor which removes the antihalation dye backing from film prior to processing. Designed for fast change-over from standard to jet-back film, Jet-Back-Scrubber can be installed or removed in a few minutes without modification to the basic processor.

Auto-Feed Pen Holder

A new Speedball Auto-Feed Pen Holder has been put on the market by C. Howard Hunt Pen Co., Dept. GS, Camden, N. J. The first automatic pen holder to hold regular Speedball pen points, it fills like a fountain pen with India ink or colors. It has push-button feed for uninterrupted speed writing and precision, clips into pocket for easy carrying.

Drawing Pen Set

Ruling, lettering, tracing, and writing are done with equal facility by the new Draftech P395/C pen set made by Alvin & Co., Inc., Dept GS, 211 Palisado Ave., Windsor, Conn. The fountain pen set comes with pen, rubber nib wrench, and six interchangeable drawing point sections, in line widths from superfine to extra broad. Filled directly from the bottle, the pen avoids constant refilling, has a transparent window to indicate ink supply. Built-in refill cap prevents loss. Each interchangeable section has a precision designed stylus guide; each nib is packed in a color-coded plastic container, with line width indicated.



Drawing File Folders

For the filing of groups of tracings in horizontal file drawers there are now on the market some new plastic folders. The manufacturer claims they permit faster referal to, and replacement of, groups of tracings, with less risk of damage. Plastic is transparent and .012" thick. They can be obtained from Best Yet Products, Dept. GS, 10719 S. Rhodes, Chicago 28, Ill., in the following sizes: 9" by 12", priced at $1; 12" by 18", priced at $1.50; 18" by 24", priced at $2.50; 24" by 36", priced at $3.50; 36" by 48", priced at $7.

New Printer

A 1961 version of the Miller-Trojan Model FVP fluorescent contact printer, now on the market, has a counterbalanced clam-shell type lid on models ranging in size from 38" x 50" to 64" x 144" and a motor-driven lid on other model sizes. This unit, used widely in photo drafting, for printed circuits, photographic templates, restoring worn drawings, aerial surveys, etc., has many new and improved features. The maker, Miller-Trojan Co., Dept. GS, Troy, Ohio, also recently announced its Miller-Trojan Universal Incandescent-Fluorescent contact printer can now be equipped with control switches for dodging purposes. This fact, plus other new features, enables the Universal to handle the whole variety of industrial emulsions, from projection speed to direct positive.

New Literature

Systems in Flow is the title of a 32-page booklet prepared by Photostat Corp., Dept. GS, 1001 Jefferson Rd., Rochester 3, N. Y. This systems study demonstrates the possibilities of the flow technique, illustrates the potential of the flow principle, shows how it may be applied to office procedures. Included also are illustrations and descriptions of Photostat's film-printers, cameras, reader-printers, and other products.

Diffusion Transfer Films are the subject of a four-page pamphlet, which is also a price list, of Ampto, Inc., subsidiary of Anken Chemical & Film Corp., Newton, N. J. Described are the company's six different types of positive films and the special waterproof negative papers recommended for use with them, as well as three Ampto translucent positive papers and several transfer negatives.

Over 300 Type Styles and sizes are illustrated in the new type specimen book produced by Fototype, Inc., 1414 W. Roscoe St., Chicago 13, Ill. The 68-page book is the company's largest catalog, and the first to include its latest product, Rule-Pak, self-adhesive, pre-cut strips of printed typographical rules and borders. Unique features a liberal sprinkling of informative paragraphs offering practical pointers on type selection, layout, and paste-up procedures.

Carbon Backing Materials are the subject of recent literature released by Ozalid Div., General Analine and Film Corp., Johnson City, N. Y. Six different types of opaque carbon paper are described and priced in various quantities. Of interest: a new opaque carbon paper that prints on the back of the master sheet to give added sharpness and density for whiteprint and blue print copying.

The Kalvar Micro-Frame Developer is pictured and described in a booklet from Kalvar Corp., Dept. GS, 909 S. Broad St., New Orleans 25, La. Special feature of the developer: it will selectively develop an exposed area of Kalvar film, permits selective printing and developing of microimages weeks, months, or years later.

Solutions for Special Filing Problems are offered in the new Atlas Reference Chart. Listed are the many sizes and types of layouts, drawings, blue prints, art work, swatches, accounting forms, stencils, offset plates, and negatives that may be filed in the Atlas filing systems. The correct hangers and cabinets available for each item are indicated. For a free copy of the chart and the latest literature write Atlas Vertical Filing Systems Div., 16716 Westfield Ave., Cleveland 10, Ohio.

(Copies of the literature reviewed can be obtained directly from the manufacturer or publisher. Complete addresses are included.)

vestment Casting Processes are the subject of the re-ed second edition of an informative pocket-size book led "How to Design Precision Investment Castings." is illustrated guide to metal-working executives and sign engineers supplies details on the benefits and limi-ions of the lost-wax investment casting process, also cusses in detail many basic design principles as they ply to investment casting processes. A materials chart ing physical properties and uses of some of the more pular metals is included. Free copies are available from dwest Precision Castings Co., Dept. GS, 10703 incy Ave., Cleveland 6, Ohio.

aftette Portable Drafting Instrument is described in erature available from the Draftette Co., Dept. GS, x 794, Beverly Hills, Calif. Included are list of com-nies who already use the Draftette, a price list, and order form.

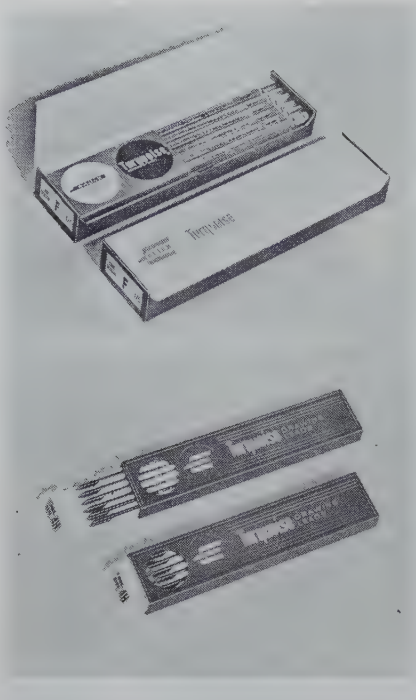
e Kalvar Developer, a high speed, continuous roller pe unit for developing Kalvar films, is described in a ur-page leaflet from Kalvar Corp., Dept. GS, 909 S. pad St., New Orleans 25, La. Dimensions, electrical quirements, and prices are included.

lustrial Photographic Line is described in a new 24-ge catalog and price list by Anken Chemical & Film rp., Newton, N. J. The booklet is devoted primarily to gineering and other industrial photographic papers and ns, includes also the company's projection materials for gineering, offset printing, microfilm and related uses, direct positive papers and films, monobath papers and ocessing solutions, diffusion transfer processors, and ious darkroom and processing machine developers, ers, and solutions. Special feature: a section on dark-m tips and a comparison chart on more than 30 con-t and projection papers and films available for engi-ering, graphic arts, and other industrial and commercial s.

hat Makes You So Curious?" is the title of a new 6-page chure published by Keuffel & Esser Co., Dept. GS, ird and Adams Sts., Hoboken, N. J. Answers are given 110 of the questions asked most commonly by those ncerned with reproduction and drafting processes and terials. Sections are devoted to drafting film, slide rules, Zeiss level, drawing instruments, planimeters, and odolites. Typical questions, to which answers are sup-ed: What causes photographic images (silver halide) to nge size? Who invented the slide rule? What is a etition theodolite?

General Catalog describing its products, illustrating m, and giving prices has been issued recently by C-Thru er Co., Dept. GS, 823 Windsor, Hartford, Conn. The page catalog covers protractor rulers, metric and stand-rulers, temperature conversion scales, dividers, slide s, area and engineering scales, triangles, French curves, ses, T-squares, etc.

nterbalanced Drafting Tables are the subject of a nt folder issued by Ozalid Div., General Analine & n Corp., Dept. GS, 521 Corliss Lane, Johnson City, Y. Nestler Drafting Machines and Tables, which range size from table-top and portable units to extra-large, om installations, are fully described and priced. For ature, write the manufacturer above.



Drawing Pencils and Leads

A new lead of substantially greater point strength, smoothness, durability, blackness, and opacity has been announced by Eagle Pencil Co., Dept. GS, Danbury, Conn. This new lead has been used in all Turquoise pencils for the past nine months; it is now combined with completely new Raymond Loewy restyling. Included in the restyling, and all containing the improved lead, are the Turquoise drawing pencils, pencils with erasers, drawing leads.

(For additional information regarding the new products described here, contact the manufacturer directly. Complete addresses are included.)

Portable Copier

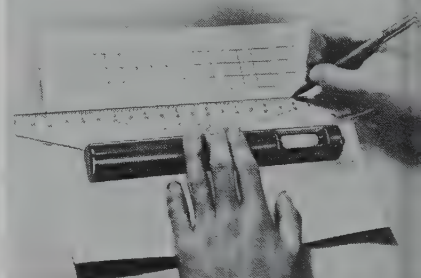
Portability in photocopying is possible with the Attache, a unit built into an attache case by Anken Chemical & Film Corp., Dept. GS, Newton, N. J. The manufacturer claims this is the first diffusion transfer machine specifically designed to travel. The traveling photocopier can go with engineers, construction men, and others, come back with the same sharp prints as are made on an office photocopier.

Microfilm Reader

The first low-cost motorized film reader developed for viewing microfilm images has just been put on the market by Recordak, Subsidiary of Eastman Kodak Co., 415 Madison Ave., New York 17, N. Y. The Recordak Starlet accepts 16 mm. microfilm contained in Recordak film magazines; can with a simple adapter be made to accept microfilm spooled on conventional reels. Its versatility, plus its light weight (32 lbs.), permit organizations using microfilm in either form to retrieve records more quickly and easily than with hand-operated units.

Circular Slide Rule

A new circular slide rule, calle Acudial, provides a more rapid mea of calculation than ordinary slid rules, can also be operated with o hand. The principle of moving scal is the same as that of the straig rule; revolving disc constructio eliminates tedious extra settings r quired by conventional circular slid rules, but retains the endless sca concept eliminating need for rese ting required by a running-off sca on a straight rule. Six models a available. Write Fullerton Enginee ing Sales Co., 4623 York Blvd., L Angeles 41, Calif.



Calibrated Drawing Aid

A plastic 12" combination triangl T-square and parallel ruler for draw ing vertical, horizontal, and parall angular lines in automatically mea ured distances quickly and easily being sold under the name Rol-Rule A built-in roller allows smooth, eas movement up or down when drawin lines. Circles and arcs can be scribe up to a diameter of 22" and lin can be spaced the same or varie distances apart. Distributor is Ro Ruler Co., Dept. GS, P. O. Box 16 Riegelsville, Pa.

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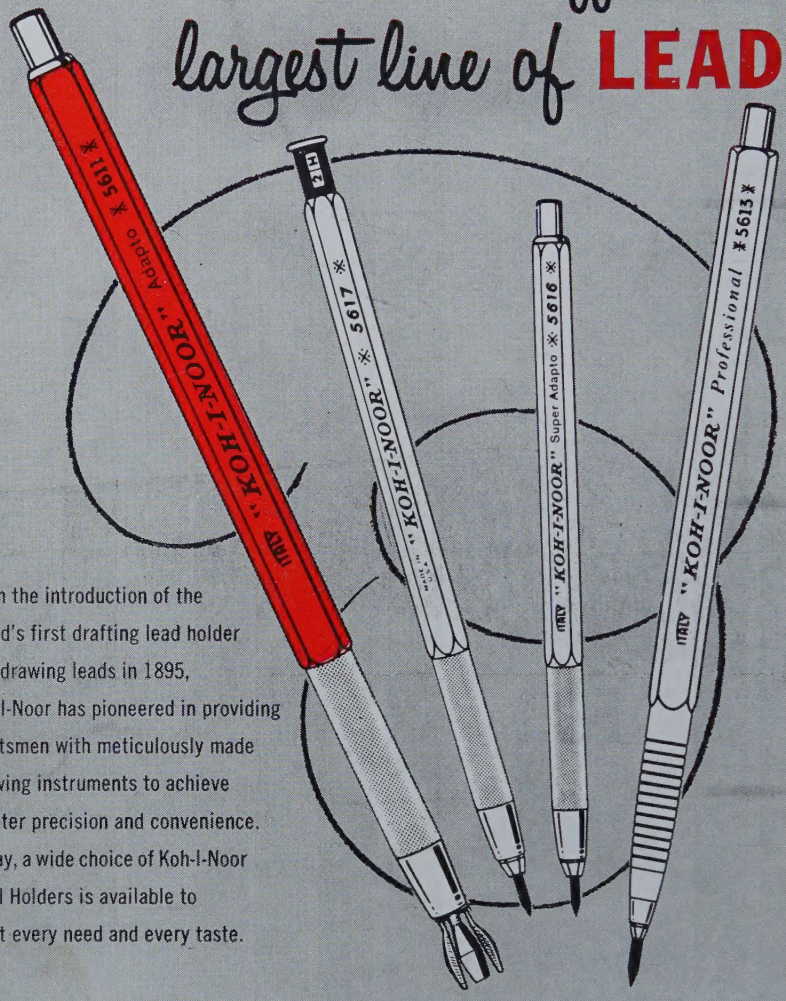

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No. 5613—New, lightweight, low priced, quality holder, perfectly balanced, with non-slip, non-turn replaceable clutch.

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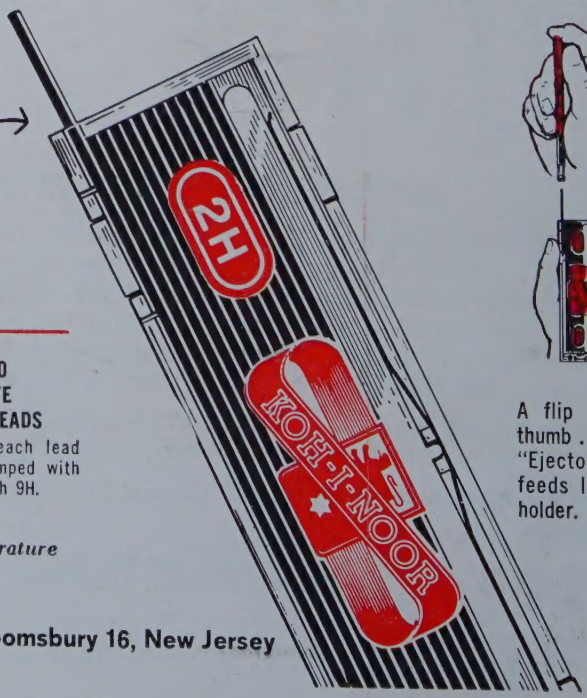
KOH-I-LAR
PLASTIC LEADS
Six degrees (6H, 4H, 2H, HB, B, 3B) for use on DRAFTING FILM, in Ejectomatic Dispenser.

No. 2200-I
NEW EJECTOMATIC
LEAD DISPENSER
A flip of the thumb feeds lead from this compact plastic dispenser to the holder, cleanly without need to touch lead. Available in 17 degrees of graphite and 9 colors.

No. 2200-D
DUETTE
Handy plastic slide-top box contains 2 sharpened and imprinted leads of a degree. Available in all 17 degrees.

No. 2200
GRAPHITE
DRAWING LEADS
Six to a box, each lead pointed and stamped with degree. 6B through 9H.



A flip of the thumb . . . and "Ejectomatic" feeds lead to holder.

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